

AMENDMENTS TO THE CLAIMS

The listing below of the claims will replace all prior versions and listings of claims in the present application:

Listing of Claims:

Claim 1 (currently amended): A disinfection reactor for disinfecting a liquid by exposing the liquid to ultraviolet light, said reactor comprising:

a. a reactor vessel defining an enclosure, the reactor vessel including a flow channel and a liquid inlet for receiving liquid to be treated and a liquid outlet through which treated liquid passes;

b. at least two spaced, tubular ultraviolet lamps positioned between the liquid inlet and the liquid outlet and having their respective longitudinal axes positioned substantially transversely relative to the direction of liquid flow through the flow channel;

c. a plurality of liquid guide surfaces positioned within the reactor vessel for guiding liquid to flow over the at least two ultraviolet lamps for exposure of the liquid to ultraviolet light, wherein the guide surfaces define at least one converging flow section upstream of the ultraviolet lamps, and wherein liquid flowing through the reactor vessel traverses a converging ~~turbulent~~ flow pathway providing a reduced cross-sectional area flow pathway adjacent to the ultraviolet lamps for enhancing disinfection efficiency.

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Claim 2 (original): A disinfection reactor in accordance with claim 1, wherein the liquid guide surfaces are defined by a pair of opposed surfaces carried within the reactor vessel, the opposed surfaces spaced from each other to define a flow channel therebetween that is in communication with the liquid inlet and the liquid outlet, wherein the flow channel includes a reduced-area throat section.

Claim 3 (original): A disinfection reactor in accordance with claim 2, wherein at least one of the lamps is disposed upstream of the reduced-area throat section and at least one of the lamps is disposed downstream of the reduced-area throat section so that liquid flowing through the flow channel passes over and around each of the ultraviolet lamps to disinfect liquid flowing through the flow channel.

Claim 4 (original): A disinfection reactor in accordance with claim 3, wherein the at least two lamps have respective longitudinal axes that extend substantially perpendicularly to the direction of liquid flow through the reactor vessel.

Claim 5 (original): A disinfection reactor in accordance with claim 2, wherein the reactor vessel includes at least three tubular ultraviolet lamps, one of which is positioned at the reduced-area throat section.

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Claim 6 (original): A disinfection reactor in accordance with claim 2, wherein the flow channel has a rectangular cross section between the opposed liquid guide surfaces.

Claim 7 (original): A disinfection reactor in accordance with claim 2, wherein the opposed liquid guide surfaces are convexly curved.

Claim 8 (original): A disinfection reactor in accordance with claim 2, wherein the flow channel has a substantially rectangular cross section.

Claim 9 (original): A disinfection reactor in accordance with claim 2, including an inlet flow baffle member positioned upstream of the reduced-area throat section.

Claim 10 (original): A disinfection reactor in accordance with claim 9, wherein the inlet flow baffle member includes a plurality of apertures that extend through the flow baffle member for substantially uniformly distributing the liquid to be treated across the flow channel.

Claim 11 (original): A disinfection reactor in accordance with claim 2, wherein the opposed liquid guide surfaces each have a surface reflectance of at least about 80% on opposed faces thereof that define the flow channel.

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Claim 12 (original): A disinfection reactor in accordance with claim 11, wherein opposed faces of each of the liquid guide surfaces include an overlying reflector member for reflecting into the flow channel at least a substantial portion of the ultraviolet light that impinges on the opposed faces.

Claim 13 (original): A disinfection reactor in accordance with claim 12, wherein the reflector members are polished aluminum sheets.

Claim 14 (original): A disinfection reactor in accordance with claim 13, wherein the polished aluminum sheets are removably fastened to the liquid guide surfaces.

Claim 15 (original): A disinfection reactor in accordance with claim 1, wherein the liquid guide surfaces each include at least one flow deflector vane for deflecting flowing liquid into the interior of the flow channel.

Claim 16 (original): A disinfection reactor in accordance with claim 15, wherein the flow deflector vanes extend transversely across substantially the entire flow channel.

Claim 17 (original): A disinfection reactor in accordance with claim 16, wherein the flow deflector vanes are carried by reflector members that overlie opposed faces of the liquid guide surfaces.

Claim 18 (original): A disinfection reactor in accordance with claim 12, wherein the reflector members include an overlying clear polymeric protective coating.

Claim 19 (original): A disinfection reactor in accordance with claim 12, wherein the reactor vessel includes an access cover for allowing access to the reflector members.

Claim 20 (original): A disinfection reactor in accordance with claim 1 wherein the ultraviolet lamps are medium pressure lamps.

Claim 21 (original): A disinfection reactor in accordance with claim 1 including a chemical oxidation agent injection system positioned adjacent the reactor inlet for injecting a chemical oxidant into liquid that enters the reactor vessel.

Claim 22 (original): A disinfection reactor in accordance with claim 21, wherein the chemical oxidation agent injection system includes a source of hydrogen peroxide for injection into the liquid for additional disinfection and for additional oxidation of contaminants contained in the liquid.

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Claim 23 (original): A disinfection reactor in accordance with claim 21, wherein the chemical oxidation injection system includes a perforated distributor member for distributing a chemical oxidant across the flow direction of the liquid to be treated in the reactor vessel.

Claim 24 (original): A disinfection reactor in accordance with claim 23, including an inlet flow baffle member positioned upstream of the reactor vessel reduced-area throat section, wherein the distributor member is disposed between the baffle member and the reduced-area throat section.

Claim 25 (original): A disinfection reactor in accordance with claim 21, wherein the chemical oxidation agent injection system includes means for injecting into the flow stream a cleaning solution for cleaning surfaces through which ultraviolet light is emitted into the flow channel.

Claim 26 (original): A disinfection reactor in accordance with claim 1, including an actinometric sampling system for monitoring ultraviolet light intensity in the flow channel within the reactor vessel.

Claim 27 (original): A disinfection reactor in accordance with claim 26, wherein the actinometric sampling system provides an output signal representative of the intensity of ultraviolet light emitted into the liquid within the flow channel, and a variable power level control for increasing electrical power

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supplied to the ultraviolet lamps in response to the output signal from the actinometric sampling system.

Claim 28 (original): A disinfection reactor in accordance with claim 1, including a liquid flow rate measuring device for providing a flow rate signal, and a motor-operated flow control valve positioned within the liquid flow path for controlling the liquid flow rate to a desired flow rate in response to the flow rate signal.

Claim 29 (original): A disinfection reactor in accordance with claim 28, wherein the flow rate measuring device includes a first pressure tap at the reduced-area throat section of the flow channel for sensing throat section static pressure, and a second pressure tap spaced from the throat section for sensing a second static pressure to provide a differential pressure to enable determination of the liquid flow rate.

Claim 30 (original): A disinfection reactor in accordance with claim 1, wherein the ultraviolet lamps are carried within respective tubular quartz sleeves that are supported at opposed sidewalls of the reactor vessel.

Claim 31 (original): A disinfection reactor in accordance with claim 30, including sealing means for sealing the ultraviolet lamps from contact with liquid that flows within the flow channel.

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Claim 32 (new): A disinfection reactor in accordance with claim 1, wherein the liquid guide surfaces include a plurality of deflector plates that extend across the reactor vessel and that are inclined relative to a reactor vessel longitudinal axis that is substantially aligned with a liquid flow direction through the reactor vessel, wherein the deflector plates define a plurality of spaced flow passageways.

Claim 33 (new): A disinfection reactor in accordance with claim 32, wherein the liquid guide surfaces include deflector plates that are connected with and extend inwardly from a pair of opposed reactor vessel walls.

Claim 34 (new): A disinfection reactor in accordance with claim 33, including a plurality of inclined inner deflector plates positioned between and spaced from the wall-connected deflector plates.

Claim 35 (new): A disinfection reactor in accordance with claim 34, wherein pairs of the inner deflector plates define V-shaped members.

Claim 36 (new): A disinfection reactor in accordance with claim 35, wherein the apices of the inner deflector plates point in an upstream direction relative to flow of fluid through the reactor vessel.

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Claim 37 (new): A disinfection reactor in accordance with claim 35, wherein the inner deflector plates include V-shaped members that point in both upstream and downstream directions relative to flow of fluid through the reactor vessel.

Claim 38 (new): A disinfection reactor in accordance with claim 32, including cleaning solution conduits positioned downstream of the deflector plates, relative to the direction of fluid flow through the reactor vessel, wherein the cleaning solution conduits include apertures oriented to direct a cleaning solution toward the ultraviolet lamps.

Claim 39 (new): A disinfection reactor in accordance with claim 32, wherein the reactor vessel has a rectangular cross section relative to the direction of fluid flow through the reactor vessel.

Claim 40 (new): A disinfection reactor in accordance with claim 32, wherein the ultraviolet lamps are medium pressure lamps.

Claim 41 (new): A disinfection reactor in accordance with claim 32, including an actinometric sampling system for monitoring ultraviolet light intensity within the reactor vessel.

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Claim 42 (new): A disinfection reactor in accordance with claim 41, wherein the actinometric sampling system provides an output signal representative of the intensity of ultraviolet light emitted into liquid within the reactor vessel, and a variable level power control for increasing electrical power supplied to the ultraviolet lamps in response to the output signal from the actinometric sampling system.

Claim 43 (new): A disinfection reactor in accordance with claim 32, including a plurality of ultraviolet lamps positioned relative to the deflector plates so that incoming liquid that is deflected by the deflector plates flows over and around the ultraviolet lamps to expose the liquid within each passageway to ultraviolet light.

Claim 44 (new): A disinfection reactor in accordance with claim 43, wherein the deflector plates define a pair of spaced, substantially parallel flow passageways.

Claim 45 (new): A disinfection reactor in accordance with claim 44, including a pair of ultraviolet lamps positioned relative to the deflector plates to lie within each of the flow passageways to cause liquid flowing within each passageway to pass successively over and around a pair of ultraviolet lamps.

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Claim 46 (new): A disinfection reactor in accordance with claim 44, including three ultraviolet lamps positioned relative to the deflector plates to lie within each of the flow passageways to cause liquid flowing within each passageway to pass successively over and around three ultraviolet lamps.

Claim 47 (new): A disinfection reactor in accordance with claim 43, wherein the deflector plates define three spaced, substantially parallel flow passageways.

Claim 48 (new): A disinfection reactor in accordance with claim 47, including a pair of ultraviolet lamps positioned relative to the deflector plates to lie within each of the flow passageways to cause liquid flowing within each passageway to pass successively over and around a pair of ultraviolet lamps.

Claim 49 (new): A disinfection reactor in accordance with claim 47, including three ultraviolet lamps positioned relative to the deflector plates to lie within each of the flow passageways to cause liquid flowing within each passageway to pass successively over and around three ultraviolet lamps.